The Metaphysics of Technology: Developing a definition of technology through the analysis of authoritative opinions in the literature

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The The Metaphysics of Technology

Many attempts at capturing the nature of technology and how we define it have been made throughout history. According to Skrbina (2015) it is in the work of pre-socratic Greek philosopher, Heraclitus, that we first glimpse the principle of (divine) ordering in the word "Logos", which is followed with Plato's efforts that explicitly address and connect the fact that the principle of Logos, or "ordering" in the human sense or otherwise, implicates the principle of creation that was conveyed in the meaning of "Techne." Nevertheless, it was only over the last century and a half that the use of the word and incarnations of its meaning to describe various concepts has become widespread sparking interest in the core ideas that its use attempts to capture.

As read in the text by Volti (2009), the word "Techne" is widely known to originally mean "skill" and "art." Reconciling both interpretations of the Greek word is facilitated by appealing to the logical connection that exists between them: to create anything requires skill and art. Both skill and art may be considered metonyms for creation. Nevertheless, the author suggests that they each refer to and describe the same core concept of creation but with asymmetry of circumstances about that central core. In other words, we may view skilled consisting of an asymmetrical a structured approach about creation where one executes to completion according to a prearranged plan without encountering obstacles whereas an artistic approach is asymmetrical about its core of creation in that the ability to create in a preplanned structured fashion is hampered by challenges or obstacles encountered, but one possesses the expertise to be guided by spontaneity and unpredictably compensates in order to see the process to fruition.

Perhaps the difference about creation may be more easily understood from the perspective of control in that skill involves both having control over conditions and exerting control over them whereas art may be viewed as lacking control over conditions yet dominating the situation through exerting control. From the author's perspective, *skill and art may be likened to chiral molecules in that the author views them as non-superimposable mirror images of one another due to the presence of asymmetry in control about the center of creation* (Merriam-Webster, 2016). If we are to be successful in our research efforts and develop a definition that appeals to the metaphysics of technology, then thoroughly appreciating the principle of chirality inherent in both skill and art is absolutely critical to completely capture and comprehend the core of create in "Techne."

Research Topic

The schematic definition of technology presented in Society and Technological Change (Volti, 2009) contained the element of "creation, " yet it was determined to be an unsatisfactory definition that did not fully capture what technology truly is in all of its forms. One practical issue concerns instances of technology in existence that mankind need not create in order for them to exist. Volti's definition does not allow for such examples of technology to be considered, nor do any of the authoritative ones that we consider from the literature in this paper. Through exploration and analysis of the definition of Volti, Bigelow, and other experts regarding the essence of technology through a metaphysical, sociological, and scientific lens we will find both strengths and weaknesses whose inconsistency allows legitimate examples of technology to fail to meet the stipulated criteria.

From an ethological perspective, it is not that humans must create or use something in order for it to qualify as technology; it is that, in order for something to satisfy the criteria to be

considered technology the requisite highly organized structure and ability to understand or apply it implies that *it was created or can be used for a purpose*. By critiquing the authoritative cases of definition, we will not only be able to synthesize the evidence we accumulate, but in doing so we also liberate the true essence of technology and successfully construct a more thorough and comprehensive definition that will identify technology regardless of form.

Research Significance

So as not to potentially detract from the significance of the study emphasis was placed on the tenets of credibility and confirmability according to Lincoln & Cohen's (1985) evaluative criteria by establishing the level of overall trustworthiness through the use and selection of authoritative sources from the literature (Cohen & Crabtree, 2006). The significance of the present study rests with the potential for the findings that are obtained due to the conscious decision that was made to bracket the author's own anthropocentric tendencies in order to approach the research from an ethological vantage point that would allow the fundamental aspects of the essence of technology to be ascertained while avoiding the ubiquitously deontological presumption of humans intelligence as the obligatory subject or object when attempting to define the word.

The Research Problem

The definition of technology given by Volti does not account for technology in all of its forms. Therefore, if we are to accept the currently used schematic definition of technology that he presents, then we will exclude many important ideas of technology. Such theories neglected to acknowledge, or underemphasized, the fact that both the making and use of tools does occur in animal species other than human (Boesch & Boesch, 1984). From an ethological perspective, the manipulation or control of an environment to serve a purpose in which humans engage and is

deemed characteristic of their behavior also occurs with chimpanzees transporting hammers for the purpose of splitting nuts (Boesch & Boesch, 1984). Of the individual authoritative definitions retrieved, none seriously considered incorporating into a comprehensive definition the ethology of technology applied to nonhuman animal species displaying human-like characteristics, nor did they provide sufficient explanation or detail robust enough to account for all forms of technology made or used. The disappointment that resulted from the author's literature survey prompted the following research question: Of what elements should a comprehensive definition of technology be comprised from an ethological perspective?

Methodology, Framework and Epistemology

The overall arrangement of this study was designed to achieve two main goals: that of discovery of aspects and invention of theory related to the definition of technology. The process of analysis leads to discovery, and that of synthesis leads to invention (Beaney, 2014). The method of analysis used was geometrical in that by working in reverse from authoritative statements regarding theory of technology the author was able to discover some fundamental truths about its essence (Beaney, 2014). After having discovered them, these truths were used as premises in the argument to justify synthesizing a comprehensive definition capturing the nature of technology more accurately.

The approach was made within the context of a philosophical framework relying on principles and applications of logic and reason to interpret meaning and derive conclusions through argumentation. Our vantage point included an ethological perspective that acknowledges for purposes of comparison the role of human characteristics as they relate to our ability to understand the requisite aspect of interactivity involved in technology without actually requiring that humans be the animal species to interact in order for something to be considered

technology. The author values governing oneself by logical reasoning and believes that consistency and coherence ultimately provide insight regardless the subject. Every effort to bracket my biases has been made, but the author has disclosed to the best of my knowledge any and all pertinent information that could potentially bias the findings so that the reader may determine for themselves whether they are in agreement.

Developing the Argument: Establishing the Link Between Art and Skill

Techne as a word-root is traditionally understood to refer to "art" or "skill" (Skrbina, 2015). The contemporary usage of words incorporating this root have the implication that a certain amount of skillfulness or artistry must be involved in that to which they refer. Nevertheless, what is often overlooked is the fact that, while skill or art undoubtedly are involved, implicit in them is a common conceptual precursor integral to that to which the word may refer as well as the skill and artistry that are requisite themselves: the notion of creation.

Inferring core aspects of Technology to Develop a General Definition

Skill is employed to create things in the same fashion that artists create their work. However, one need only to observe the results of skill and art to understand that something was "created." The fact that something was created may be concluded from the overall organization; things were done the way they were so that every aspect of the work or object *functioned* together with *purpose* that can provide some *benefit* (aesthetic or otherwise). That is, if something discovered is organized, then it may be inferred from the function, purpose, and benefit that it was created without the need to establish who or what was responsible for creating it. Therefore, these three are considered by the author as the necessary core aspects of any example of technology.

The original meaning of the root Techne (i.e., create) and logos (i.e., ordering - words that are ordered consisting of letters that are ordered to make them; logic as in series of steps in order, and reasoning also in steps) when combined should be understood to refer to a "creation of order" (i.e., as in skill or art used to create order yielding work), or that in which "order is created. In other words, from the perspective of making meaning, the author interprets and defines technology generally at its core to be either "*something created through ordering exhibiting organization whose aspects function with a purpose that can provide some benefit*," or "*something that is organized (implying creation of order) whose aspects function with a purpose that can provide some benefit*."

Volti's Schematic Definition of Technology

One way to understand technology is through the schematic definition presented in the text entitled "Society and Technological Change" (Volti, 2009). In it, technology is defined as "a system created by humans that uses knowledge and organization to produce objects and techniques for the attainment of specific goals" (Volti, 2009, p. 6). Examples that currently exist such as the laser, the television, or the computer all qualify as technology according to the criteria of this definition. Although it may prove exceedingly difficult to deny any of the aforementioned examples a place among the pantheon of technology according to how Volti has defined it, there still exist examples that would not be given full consideration mainly due to qualifying it with "created by humans," which is very problematic.

The Elements of Technology and Aspects According to Bigelow

Jacob Bigelow who is often credited with coining technology in its present-day usage (Li-Hua, 2012) was both a physician and Harvard Professor in the early nineteenth century. In his book entitled *Elements of Technology* (1829), Bigelow states that technology (at that point in

time) was “understood to consist of principles, processes, and nomenclature of the more conspicuous arts, particularly those which involve applications of science, and which may be considered useful, by promoting the benefit of society, together with the emolument of those who pursue them” (Bigelow, 1829). It may not immediately be apparent the abundance of information that was provided, so the author encourages readers to take a second look to fully appreciate its complexity as a reflection of that of technology itself.

Analyzing Bigelow’s statement that is taken as true on authoritative grounds reveals that technology, conceptually, was comprised of the following aspects: the physical (process), the metaphysical (principles), the sociocultural (nomenclature), the functional (application of science), the beneficial (considered useful), the purposeful (promoting societal gains), and the economical (emolument). Although the aspect of product was not expressly mentioned, it is implicit to the aspect of process, which is taken to mean action, change, or transition in some form, in that a process must either culminate with itself, or with something else that is not itself; at a subsequent point in time, the continuation of the process would be the process whereas something other than itself at a subsequent point in time would be a distinct product. Both alternatives, however, may be considered products and could explain why no explicit mention was made in Bigelow’s definition.

While the author does appreciate the care taken in constructing this definition, the author does not completely agree with it in that there exists at least one example of something of which the author can think that will satisfy all of the required aspects of both Bigelow’s and Volti’s definitions to be considered technology, but does not necessarily have to satisfy any of the criteria and still exists: the hormone insulin. Based on the use of implicative reasoning for conditional statements “if an example meets the criteria for expert’s definition of technology,

then the example is technology," accepting as true Volti's definition on authoritative grounds as premises for the argument, and given insulin may be viewed as a system of delivery for energy sources into muscles that is created by humans and uses knowledge (i.e., science) and organization (i.e., skill, art implying it was created) in order to produce objects and techniques for the attainment of specific goals (i.e., modulation and usage of glucose as energy source), then insulin is technology. Moreover, accepting as true Bigelow's definition on authoritative grounds as premises for the argument, and given that this substance has been created by mankind involving a process consisting of the application of science according to principles and has been given a name, is considered exceedingly useful based on how it benefits society and those who create it, the substance, insulin, is technology.

Insulin and the Argument for Technological Determinism

According to both Bigelow's and Volti's definition, insulin is certainly technology. However, there is a rather inconvenient issue with this technology because, unlike all other forms of technology about which there is consensus such as vehicles, televisions, radios, and computers, insulin does not need to be created by humans to exist. So, either insulin is technology or it is not; if insulin is technology and insulin does not need to be manufactured, then technology does not need to be created and anything in existence that was not created could therefore be technology. On the other hand, if insulin is not technology despite satisfying all of the aspects in the criteria of the definition, then it is not the case that there exists something that is technology because insulin meets the criteria and is not technology. Therein lies the problem with the definition: either everything will be technology, or nothing will be. Such an absurdity renders the definition as it stands of no use and further substantiates the need for the present study.

In addition, the case of insulin regardless of the existing or any newly developed definition welcomes the corollary of technological determinism as an argument. The author would not go as far as to claim that insulin is autonomous just yet, but conceding that insulin is technology that can be created but exists without humans making it implies that not only can humans not take responsibility for it as technology, but since it exists without mankind making it either it came to be simultaneously with the creation of humans, or this technology preceded them. It is unlikely to have come into existence subsequent to humans for this would imply according to principles of causality that mankind created it, which is obviously false. It is also unlikely to have spontaneously developed by chance factors subsequent to humans because that would mean that there was a point in time at which insulin did not exist anywhere yet at a later point, it not only came to be, it came to be made by a particular organ of all animals including humans, pigs, canines, felines, etc., simultaneously with consistency and the same function. There is no way to accept this as plausible.

If insulin is technology and it came to be simultaneously with the creation of humans, then at best technology would be considered contingent relying on humans, or at worst it would be autonomous and coincidental to them, as well as be partially deterministic in the sense that there exists a dynamism between insulin and humans where each influences and is influenced by the other. Nevertheless, if insulin as technology preceded humans, then at best technology would be both autonomous and completely deterministic. The only way to avoid technologically deterministic implications is to deny insulin is technology, but that would be problematic considering it could satisfy the criteria of a number of authoritative definitions of technology, which would also imply that there would be other examples that qualify that must be denied.

Technology and the Aspect of Reflexivity

As we observed was the case with the aspect of process implying that of product, there are aspects that are so inextricable as to have the presence of one imply the existence of the other, which obviates the need for both to be included to obtain a satisfactory definition. The three core aspects previously discussed are among those discovered in Bigelow's definition and are precisely those from which we can derive remainder. Either from the aspect of function or that of purpose of a technology one can name, perceive, understand, and earn a living. In fact, the aspect of function can yield that of purpose and vice versa, as well as that of benefit since how it benefits explains purpose and function.

There is a minor aspect that was neither directly expressed nor easily determined from the content of Bigelow's definition or Volti's for that matter: that of reflexivity. The aspect of reflexivity captures the potential for technology to not only "do itself," but "to be used to do," which is the active and passive aspects of technology. Though minor, it is very important and complements the major, or core, aspects from which all the other can be derived.

Diverging Definitions of Technology

From an anthropological standpoint, many views equated technology with things such as tools like those utilized by mankind throughout history (Nelson, 1932; Wissler, 1928). Though rather incomplete relative to the attempt that we just analyzed by Bigelow (1829), or Volti (2009) previously, such a definition underscores the importance of the study of technology to anthropologists. Nonetheless, as noted by Bleed (2008), technology is poorly understood and ill-defined with both material and nonmaterial aspects confused or studied in isolation (p. 95).

Consideration of Feminist Perspective

Perhaps technology is ill-defined because the physical and immaterial aspects are fused, as suggested by Haraway (1997) who likened mankind to cyborgs. Such human-machines where

machine is metonymically representative of technology that is inextricably part of us all, is comprised of a duality where material and immaterial, , what creates and is created, the mind and the body coexist interdependently. This brings to mind Descartes and dualism's adherents from the philosophy of mind (Rey & Frank, n.d.), but Haraway's is not the only view of technology that had dualistic undertones, however. The perspective provided on technology given by Wacjman (2009) exhibited similar traits. According to Wacjman (2009), scientific facts and technological artifacts have been treated as both semiotic and as material (p. 2), which may be understood as a fluidly-fixed hybridized duality in which the active role of hermeneutics as a framework for general interpretation influences, and is influenced by, the relatively passive role of observation of the traditional physical sciences. When this dynamism is taken as a premise for any argument, however, it leads to absurdities due to the inherent contradiction. Any definition, therefore, must be developed with logical consistency in mind to be sufficient.

Technology as Dichotomously Physical

Technology has been described in terms of distinct "inputs" such as knowledge and labor and "outputs" referred to as material culture or modified environments by Boas (as cited in McOmber, 1999). This is a dichotomously physical definition of technology, which acknowledges or implies both physical and metaphysical aspects. Subdivisions within this category include definitions with distinctive aspects, and those with a conceptual mosaic of interwoven aspects. Nevertheless, it is exceedingly difficult to accept theories comprised of material aspects of technology without conceding the metaphysical. Another definition of technology is that it is "composed of the material, mechanical, physical, and chemical instruments, together with the techniques of their use, by means of which man, as an animal species, is articulated with the natural habitat" (White, 1949, p. 364)" (McOmber, 1999). While

the author concedes techniques could be immaterial in isolation (i.e., mental relaxation techniques, focus, etc.), the phrasing of "techniques of their use" joins the use of material instruments without actually mentioning or implying metaphysical aspects.

Conceptual Sensitivity and Conceptual Specificity

The absence of metaphysical aspects from authoritative definitions seriously compromises what the author refers to as conceptual sensitivity and conceptual specificity. Borrowing core concepts of sensitivity and specificity from the fields of medical and epidemiological research (Boslaugh, 2015), by conceptual sensitivity the author is referring to the ability of a definition (as a test) to accurately identify cases of that which it purports to define. Conversely, conceptual sensitivity is used by the author to refer to a definition (as a test) that does not identify a case as that which it is to define when, in fact, the case is not.

Any comprehensive definition should minimize the occurrence of false identification of things as technology when they truly are not (i.e., type 1 error), as well as minimize falsely rejecting the qualification of things as technology that actually are (i.e., type 2 error). Therefore, the most crucial aspects of any adequate definition of technology, regardless of it expressing a primarily material essence or a dichotomously physical nature, are that it should both (a) be conceptually sensitive enough to allow for only valid examples of technology to be identified through meeting the criteria, and (b) for it to be sufficiently and conceptually specific to identify only valid examples of technology. These ideas will be revisited in a later section when we build the framework for definition.

The Anthropocentric Standard for Defining Technology

One prominent theme that was overt or implied in many of the authoritative statements regarding technology was that humans are either benefactors or the creators who are inextricably

and uniquely associated with it, which renders these perspectives anthropocentric. Noted expert Carl Mitcham (1978) defined technology as "human making or using of material artifacts in all forms and aspects" (p. 232). Mitcham's anthropocentric view was joined by many others, including those who suggested that technology is not just a practical implementation of intelligence, but one of human intelligence (Ferre, 1988). Either attempt at defining technology as making and using, or a practical implementation does so through the physical without the metaphysical. Furthermore, that it was the human aspect that qualified something as technology was both widely and inappropriately accepted as truth for many years. Nonetheless, as previously mentioned in this paper, research would reveal this belief to be inaccurate at best (Boesch & Boesch, 1984).

Although it has been more than three decades since the evidence of chimpanzees, significant evidence does exist that should have decidedly shifted the focus away from subsequent definitions of technology that are qualified by human-making, yet there have been and still are many academics whose definition resembles that of Volti (2009), which qualifies the criteria to satisfy with "human making." Many are reluctant to accept, or acknowledge, that mankind is not unique with respect to use and fabrication of technology no matter how rudimentary and cannot abandon the anthropocentric framework. For instance, Pitt (2000) defined technology simply as "humanity at work," while Johnson (2006) wrote that the very idea of technology is the idea of things that are humanmade consisting of dichotomously physical components such as systems of knowledge and sociocultural aspects that are integrated. Furthermore, according to Li-Hua (2009), "technology represents the combination of human understanding of natural laws and phenomena accumulated since ancient times to make things that fulfill our needs and desires or that perform certain functions (Karatsu 1990)" and that it

"has to create things that benefit human beings" (p. 19). Although the author concedes that it may prove difficult to refrain from such human-centered tendencies, that does not imply we should indulge them. Such an anthropocentric standard found in definitions of technology frustrates our efforts by obscuring the fundamental aspects and misdirecting attention away from the essence of technology.

Technology Consists of Aspects of "Timeless Essence"

It became very discouraging at times because, although many great ideas were available, none seem to truly capture or express what a sensitive and specific definition should. For this reason, the author completely understood the remarks in the literature by authoritative experts who expressed a sense of pessimism regarding the process of definition with respect to technology in particular, or the process as a whole in general. According to McOmber (1999), "technology is a repository of overlapping, inconsistent meanings" (p. 149). McOmber also stated that "technology, being only a word, was incapable of having a timeless essence that transcends any of the uses to which it was put (Wittgenstein, 1958)" (p. 149).

In the text chapter entitled History of Technology, Misa (2009) remarks that no scholarly historian of art today would feel the least temptation to try to define " art, " as if that complex expression of human creativity could be pinned down by a few well-chosen words" (p. 8). A similarly negative outlook was echoed by Bjiker, Hughes, & Pinch (1987) who felt any effort given to the task of precisely defining definition was unnecessary (p. 3.). Hughes would subsequently elaborate by suggesting that any definition would be a disservice to the conceptual complexity of technology and pose restriction while obscuring it.

While the author concedes that the word technology can have no timeless essence due to the evolving nature of contextual meaning, he disagrees with Wittgenstein's (as cited in

McOmber, 1999) remarks in that the concepts and aspects that comprise the essence of a particular technology no matter what they may be are unalterable and do transcend terms ascribed to them. For example, a term may be used in reference to a particular object or concept in a given context, and then it may be understood in referring to another; in this case the essence of the referent changed even though the term meaning or its use may not have (e.g., the reader's spouse: use is the same, but the referent is contingent upon who the reader is and its essence is different). Furthermore, an instance where "the reader's spouse" is first used and taken to mean "the person to whom the reader is married," and subsequently another word (e.g., husband) is substituted for spouse when we know he is male (i.e., the reader's husband) instead to refer to the same individual and relation, the essence of "the person to whom the reader is married" has remained unchanged despite the usage of different words.

It is in this same manner that that to which technology refers today comprises an unchanging essence that transcends terminology and word usage. Different words may be used to describe the same thing, and the same word may be used to describe different things; however, that to which the word does or did refer need not change at all. The only possibilities are when either a change in the word used to define or describe an identical referent occurs, or when a there is a change in the referent to which the identical word applies. We have proven that it is irrelevant and unnecessary for a word to have a timeless essence because the referent of the word itself always does. Furthermore, the existence of an unaltered timeless essence implies that there are aspects as characteristics that are in fact both consistent and identifiable regardless how conceptually complex they may seem. Upholding consistency is accomplished through establishing by idenfication what the timeless essence is, which makes doing so necessary if consistency in understanding is desired. Therefore, given this consistency and identifiability,

technology must be amenable to definition according to the aspects of its timeless essence, which we have previously established in this paper. In other words, a definition of technology is possible and necessary if we desire to understand what its timeless essence is. Moreover, despite the authoritative sources, the process of definition cannot obscure complexities or pose restriction, but approaching the task grounded in this belief as a framework will obscure and pose restriction. Such opinions both reflect, and are further confirmation of, the tendency toward anthropocentricism, as well as mankind's need to dominate. This perspective implies that the process, and therefore the one who defines (i.e., mankind), are hegemonic with respect to that which is defined, which cannot be possible if a timeless unchanging essence of technology truly exists. Definitions and the process are descriptive and do no more to restrict or obscure the aspects of any timeless essence than not attempting to define it.

Discussion: Detailed Philosophical Approach to Definition

In consideration of the analysis of the schematic definition of technology that was presented by Volti (2009), that of Bigelow (1829), as well as the additional authoritative opinions, theories, and definitions of a variety of experts from a range of fields critiqued, we concluded the following regarding what is entailed in the process of defining technology. Unlike suggested by Volti (2009), we have shown that there need not be a stipulation that "humans make" in order for criteria of a definition of technology to be satisfied. Furthermore, there were eight aspects of technology that we derived from Bigelow's case: physical, metaphysical, process (therefore, product), functional, purposeful, beneficial, and economical. Despite the many aspects obvious and implied in his definition there was at least one case that the author suggested as truly technology that would satisfy all but one aspect (i.e., economical), which reveal the inadequacy of the definition as it was. This exception in which a true example of

technology failed to meet the criteria according to the test (i.e., false negative) was reminiscent of a type II error (Martella, 2013) and is what we want to avoid or at the very least, control.

Definition with Foundations in Adequacy and Provability Logic

The author was then prompted to slightly modify then appropriate the error classification concepts of type I and II (Martella, 2013) for our purposes, as well as adopt the notion of philosophical adequacy comprised of soundness and completeness (Garson, 2006) based on concepts found in provability logics and foundation of mathematics. As the most well-known of provability logics, Godel's second incompleteness theorem essentially expresses that consistent systems cannot prove their own consistency (Garson, 2006). Originally applied within the context of an arithmetics, the axiom GL that concisely captures an important principle is named for Godel & Loeb and expresses the idea that if a system could prove soundness (i.e., consistency: there is proof that if it can be proven that T, then it is true that T) for a given sentence T, then T already has a proof. In other words, a system such as that which defines technology, if truly sound, cannot prove its own soundness because there may be a flaw with the system, which is what occurs when according to the same supposedly sound definition of technology there can be both proof of something as technology (i.e., insulin) and proof of the same thing as not technology (i.e., insulin). Soundness is extremely critical for all systems including argumentation, arithmetic, and definition because from soundness we will develop a framework for our task.

Soundness as the Foundation for Developing a Framework for Defining Technology

Interesting to note is that soundness is equivalent to what is referred to as its own contrapositive, which would mean that if it is not the case that T, then it is not the case that it can be proven that T (Garson, 2006). The contrapositive is as important to our theory development

as soundness itself. Simply because the definitions we have reviewed of the experts may be able to prove something is technology, it does not necessarily follow that what it proves is the case. Moreover, because something may not truly be technology it does not imply that it cannot be proven as such by the definition either because it is possible that the system used (i.e., definition) is inconsistent so that there may be both a proof for truth and its negation. Thus, instead of direct proof that there exists a definition of technology, if we manage to prove the soundness of a definition of technology then there is proof of the definition of technology itself. Through establishing the adequacy of a definition of technology through completeness by showing that valid examples of definitions of technology are the ones for which there is proof, and soundness mentioned previously, we will be very close to having satisfactorily developed our definition.

The information contained within the authoritative case definitions we have assumed as valid will be our premises as we proceed and apply logical rules also assumed to preserve validity. In order to satisfy completeness, if the authoritative definition is valid, then there is proof that it is. Proof that it is valid for the purposes of our research would be established when a definition consistently identifies (i.e., proves) examples of technology. Conversely, for soundness the assumption is that if the authoritative definition is valid, then the authoritative definition has proof that it is. In this case, from the assumption of consistently identifying examples in the premise of this argument, we proceed preserving validity, which means that there cannot be a case in which the premise is true and the conclusion that the definition of the expert is false. The definition of an authoritative expert is false when it does not consistently identify examples of technology. Having established the facts, according to the test for adequacy, neither Volti's, Bigelow's, nor any of the other authoritative definitions consistently identify examples of technology.

Although there will always be the risk of some type of error occurring because nothing is perfect, prudence requires that the occurrence be minimized as much in hypothesis testing (i.e., definition) as is reasonably possible. Since the main goal of our study and thesis is both interpretational and conceptual in that we aim to develop or define an idea and provide a framework for understanding, in order to be able to correctly discriminate examples of technology from those that are not, our definition as an experiment, or hypothesis test, must essentially become a test whose power to identify as technology only true examples of technology while not identifying as technology those examples that are not is maximized. Doing so will require consistency when both the definition's identification and the technology truth-status are in agreement. This positive correlational relationship between the definition and that which it is to identify is strikingly similar to the concepts found in medicine and epidemiological research referred to as sensitivity and specificity (Boslaugh, 2015). Sensitivity refers to the ability of a test to positively identify individuals who have a particular disease for which the test is designed to identify. Specificity, on the other hand, refers to the tendency for tests results to be negative for a particular disease when individuals do not have that disease.

Ultimately, utilizing the notions of adequacy in considering the relationship between a definition and that which is to be defined by it requires that we rely on a principle of soundness. The contrapositive of soundness we explained provides a logical equivalent that may be used to understand a sound relationship. Viewing the relationship between a definition and that which it defines as an argument, soundness may be considered proven when we assume that the definition is understood as proof and can consistently and correctly conclude that which is to be defined as technology is a valid example. In addition, posing an argument where we assume that which is

to be defined as technology is a valid example and can consistently and correctly conclude the definition of that which is to be define is valid results in proving completeness.

Soundness and completeness comprise the notion of adequacy, which as a condition is satisfied when the definition as a test correctly identifies technology if and only if that technology is a valid example. Such a biconditional relationship between definition and that to be defined is based on adequacy the author refers to as conceptual sensitivity, which is a reflection of the power of the definition. Furthermore, if we take the contrapositive of soundness and its inverse to be when the definition as a test does not identify technology if and only if that technology is not a valid example, then this derivative biconditional relationship is referred to by the author as conceptual specificity.

When a conclusion based on the definition as premises is not valid, then the definition incorrectly, or false-positively, identified something as technology that is not a valid example, which is a type I error. Conversely, when a definition as premises fails to identify technology that is a valid example, the definition false-negatively identified something that is technology, which is a type II error. Together, all of these concepts were synthesized to develop a framework for definition as conceptual claim of my thesis.

Claim of Concept: Tripartite Definition of Technology

According to the argument that was presented based on the analysis of authoritative evidence from the research, technology is much more complex than the definitions of Volti, Bigelow, or the experts lead us to understand. My research question asked "Of what elements should a comprehensive definition of technology be comprised from an ethological perspective?" An argument of authority was used to warrant the conclusion that addresses it, which the author presents as the claim of concept within the framework suggested in the form of a comprehensive

tripartite definition of technology as follows: *Technology is (a) something that is itself always inherently intelligent enough either to* ***function****, be used to function, to be imbued with or interpreted as having a function that only intelligent beings (human or otherwise) have the ability to comprehend; (b) something devised, designed (i.e., primary intention), or discovered (i.e., secondary intention) that serves a particular* ***purpose*** *from a purely secular standpoint without requiring that mankind be responsible for it though he may be (aspect of reflexivity of purpose – salt doesn't inherently "elevate" or do anything deliberate, but it does "elevate" the boiling point of water, which it has been found to do and can be considered to serve a purpose); (c) a significant* ***beneficiary*** *of rationally derived knowledge that is "used for" a purpose without itself necessarily being translated into something physical or material that "does" (e.g., instructional methodologies in education, processes, ideas).*

What we know or accept as science ultimately determines what technology we devise, how we design it, or what purposes for it that we may discover and later rediscover. With new technology and new uses for old technology, many of the values that we held initially are guaranteed to undergo transformation. That notwithstanding, as our values transform, so does our perception of the technology that led to the change. Such dynamism requires us to continually reevaluate our positions regarding everything while conceding that perhaps how we once thought about technology may not be the complete picture. Moreover, the existence of organized systems that either came into existence simultaneously with, or predate humans, it will no longer suffice to continue qualifying and referring to technology as that which is created by mankind according to the current schematic definition of Volti, nor will definitions like that of Bigelow be enough. Furthermore, the inadequacy of such definitions and examples of

technology such as insulin provide a platform for arguments substantiating either partial or complete forms of technological determinism.

There is no question that all forms of technology have significantly benefitted from knowledge gained from results obtained from research employing logic and the scientific method. When one considers the knowledge that has been obtained in, and benefitted, a variety of fields, there are occasions and examples where the knowledge is not and cannot be converted into a physical form. Nevertheless, advancements benefiting sociological and instructional methods satisfy almost all criteria to be considered technology, but the lack of physical form precludes full qualification. That the results of benefits of derived knowledge do not exist in physical form is not sufficient reason to exclude such examples from consideration since the remaining criteria are met. For this reason, the requirement that technology be physical was removed and the third aspect of the definition describes technology as a significant beneficiary of rationally derived knowledge that is "used for" a purpose without itself necessarily being translated into something physical that "does."

We initially introduced a general definition of technology after we deconstructed the word roots and claimed that technology is either understood to be "*something created through ordering exhibiting organization whose aspects function with a purpose that can provide some benefit*," or "*something that is organized (implying creation of order) whose aspects function with a purpose that can provide some benefit*." We considered an argument why technology may not necessarily require that it be a creation of mankind with the case of insulin. Whether the reader agrees with the origin of whatever one considers technology is irrelevant, as it is undeniable that any example of technology exhibits organization, which implicates it was created without regard to that which created it. From the notion of create it may be inferred that both

skill and art were required that resulted in such a level of organization to exist, we deduced that the technology is comprised of the three core aspects of function, purpose, and benefit that represent the timeless essence of technology. We also mentioned the aspect of reflexivity, which is not necessary and only operates through the core aspects that comprise the timeless essence of technology.

Technology is something that is itself always inherently intelligent enough either to perform functions or to be imbued with a function, purpose, or benefit that only intelligent species, human or otherwise, can appreciate (e.g., nut-cracking). In addition, we explained that technological aspects may result from primary or secondary intention depending on whether it is something devised, designed or discovered to serve a particular purpose from a purely secular standpoint without requiring that mankind be responsible for its existence. Lastly, as a significant beneficiary of rationally derived knowledge, we address an example of how technology may also be "used for" a purpose without itself necessarily being in a physical form that "does." The tripartite comprehensive definition was presented as proposed by the author in hopes of establishing and upholding the framework for definition that was developed in this paper. Given what was concluded, how is it possible for technology to be autonomous yet bar entry of valid arguments substantiating ideologies centered around technological determinism?

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